PACKAGING BULK CHEESE AT THE STORE AND THE CENTRAL WAREHOUSE

Marketing Research Report No. 706

Agricultural Research Service
U.S. DEPARTMENT OF AGRICULTURE

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PREFACE

This study on improving work methods, equipment, and layout for packaging bulk cheese at both the retail store and the central warehouse is part of a study on the retail store dairy department. Other aspects of this research were reported in Marketing Research Report No. 661, "Improved Handling of Dairy Products in Retail Food Stores."

The study was made under the general supervision of R. W. Hoecker, chief, and the direct supervision of Paul F. Shaffer, marketing specialist, Wholesaling and Retailing Research Branch, Transportation and Facilities Research Division, Agricultural Research Service.

The Red Owl Stores, Inc., and Super Valu Stores of Minneapolis, Minn.; Giant Food Stores, Inc., and Safeway Stores, Inc., of Washington, D.C.; Penn Fruit Company of Philadelphia, Pa.; Lake to Lake Dairy Cooperative of Kiel, Wis., and many other firms contributed the use of their stores and packaging plants in conducting tests.

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Trade names are used in this publication solely for the purpose of providing specific information. Mention of a trade name does not constitute a guarantee or warranty of the product by the U.S. Department of Agriculture or an endorsement by the Department over other products not mentioned.

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SUMMARY

Packaging bulk cheese at a central warehouse costs less than packaging at retail stores. A central warehouse with an annual volume of 1 million packages of cheese could package the cheese for $19,000 a year less than retail stores could. Since the warehouse would have a large volume to package, it could afford to have special equipment and trained personnel.

Four systems of packaging in the central warehouse were studied, and the least costly system was one in which an automatic sheeter supplied sheets of film to the wrappers, and the packages were wrapped manually.

A principal item in cost reduction is the cutting of bulk cheese for packaging. The cost of cutting can be reduced 56 percent by doing it in the warehouse instead of a store. The lower cost is attributable to (1) using semiautomatic cutting machines, (2) buying larger blocks of cheese for cutting, (3) cutting larger volumes, and (4) using employees with a lower pay scale than that of retail meatcutters.

Many stores use a two-girl assembly line to wrap cheese. The cost can be reduced 10 percent with one girl. An automatic "gas flush" packaging machine, which inserts gas into a leakproof package, can be used at the warehouse. Labor costs can be reduced 84 percent by using this machine in place of manual wrapping. This machine is recommended for warehouses where labor costs are unusually high or where long shelf life is essential, or both.

"Catch weight" packages (weights vary) cost less overall than "even weight" packages (all packages made to weigh the same), even though the weighing and labeling cost was less for the even weight packages. Costs of cutting even weight units, the additional shrinkage resulting from trimming the blocks of cheese to obtain pieces of uniform weight, and extra weight allowance to insure against underweight packages increased the costs of packaging even weights.

The lowest cost container for shipping packaged cheese to the stores is one that can be reused many times. When the reusable container is compared with a one-trip container, the potential saving is 3.6 cents per container trip.

PACKAGING BULK CHEESE AT THE STORE AND THE CENTRAL WAREHOUSE

By Gordon Flynn, *Transportation and Facilities Research Division, Agricultural Research Service*[1]

BACKGROUND OF THE STUDY

The dairy department of the retail food store handles many varieties of bulk cheese. The term "bulk cheese" as used in this publication refers to any cheese that is commonly shipped to the warehouse or retail store in a form other than the consumer package; that is, any unit that has to be cut into smaller units, wrapped, weighed, and priced. The manufacturer often packages and sells the same type of cheese in the form of sticks, chunks, wedges, and half moons.

A survey of 12 stores (operated by two firms), which averaged $33,000 per week in total store sales, showed that they sold an average of 296 pounds per week of bulk cheese that was packaged at the retail store or central warehouse and 61 pounds (17 percent) that was packaged by the manufacturer.

In the firms studied, four cheeses—Longhorn, Colby, Aged Cheddar, and Swiss—averaged 82.8 percent of the total weight and 81.2 percent of the total packages sold (table 1).

This study was made to evaluate different systems of packaging bulk cheese at the retail store and the central warehouse and to compare packaging costs at these locations. Improvements in methods, equipment, and layouts, which were developed in other studies, were incorporated in both retail store and warehouse operations.

The labor production standards developed during the study include an allowance of 15 percent for fatigue and personal time. The wage rates were those in effect for the firms studied and include 15 percent for fringe benefits. The package size and the percentages of the different types of cheese packaged were based on two firms, where most of the studies were conducted, which were considered to be representative of the industry. When the total bulk cheese packaging costs are being compared for alternative systems at the retail store and warehouse, it is necessary to use all costs that may be affected by the system or location. They include labor, materials, shipping containers, equipment, and burden (rent, utilities, laundry, insurance, etc.). When certain functions were compared, only those costs that were affected were used. In cutting, for example, only labor (the principal cost factor) was used to compare the operations at the store and warehouse.

Table 1.—*Percentage that each type of cheese contributes to total cheese sales at retail stores, in weight and sale units*

Type of cheese	Average weight per sale unit [1]	Percent of total sales	
		Weight	Sale units
	Ounce	*Percent*	*Percent*
Longhorn	11. 6	30. 5	32. 5
Colby	13. 3	24. 6	22. 8
Aged Cheddar	13. 3	16. 3	15. 2
Swiss	13. 3	11. 4	10. 7
Medium Cheddar	13. 3	3. 4	3. 2
Sliced American	13. 3	2. 8	2. 6
Blue	6. 2	2. 2	4. 1
Chunk American	13. 3	2. 1	1. 9
Mild White Brick	12. 0	1. 6	1. 6
Mild Colored Brick	12. 0	1. 5	1. 6
Red Wax Cheddar	13. 7	1. 5	1. 4
Medium Brick	10. 0	1. 1	1. 4
Caraway	13. 3	1. 0	1. 0
Total		100. 0	100. 0

[1] Weighted average package weight is 12.4 ounces.

PACKAGING CHEESE AT THE RETAIL STORE

CUTTING

Bulk cheese was delivered to the retail store in blocks ranging from 5 to 40 pounds either by the central warehouse or by vendors. The cheese was cut by meatcutters. They removed the cheese from the container and the paper or wax outer covering from the block of cheese and placed the block on the cutting table. A combination of a knife and a jig with a wire cutting arm was com-

[1] Mr. Flynn resigned from the Department of Agriculture before publication of this report.

monly used to cut the cheese. (See table 1 for average size of units cut.) The labor cost per unit cut for the four major items was—

	Cents
Longhorn	0.92
Colby	.64
Aged Cheddar	1.13
Swiss	.84
Average	.87

Average labor cost per unit for cutting all other types of cheese was 1.10 cents. These cheeses usually were received in smaller units than the four major types, which, to a large extent, explains the higher cutting cost. The average labor cost per unit for all types of cheese was 0.91 cent (appendix table 4). The cost per pound or per sale unit is, of course, affected by the size of the unit sold. The larger the sale unit, the less costly cutting is on a per-pound basis.

Work methods, equipment, and the physical layout also affect the cutting cost. The cutting table should be near the storage cooler. A dolly should be used to bring the blocks of cheese from the cooler to the cutting area. The cutting jig, knife, holding pans, and trash barrel should be on or near the work station. A conveyor should be adjacent to the cutting stations to carry the cut cheese to the wrapping stations.

WRAPPING

At the retail store, cheese is usually packaged either in polyvinyl chloride or in cellophane film. Cellophane is used by some firms because (1) it is less expensive than polyvinyl chloride; (2) 2 percent less material is needed to wrap the package; and (3) less labor is required because cellophane is easier to handle.

The operator pulls off the amount of film needed, cuts it with a hot wire or a toothed blade, and wraps it around the package. She then positions the package on a Teflon covered hotplate, which seals the film. The heat from the plate partially shrinks the film, which helps enhance the appearance of the package. The saving per package, when cellophane was used instead of polyvinyl chloride, was 0.04 cent for film and 0.07 cent for labor, a total of 0.11 cent per package (app. table 5).

The shrink characteristics of polyvinyl chloride film give a tighter wrap than cellophane; the tighter wrap might increase shelf life. Large-volume stores with fast turnover do not need the extra shelf life and can take advantage of the lower cost cellophane wrap. No tests were conducted to determine what effect the type of film had on shrinkage and sales.

Two methods of wrapping cheese at the retail level were studied. In one, a single operator, working at a wrapping station or bench, performed the entire operation (fig. 1).

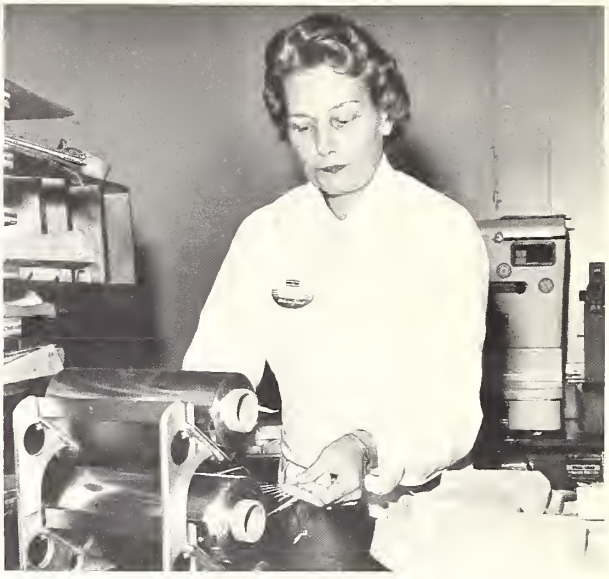

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FIGURE 1.—One operator wrapping bulk cheese at the retail store.

In the other method, two girls worked as a team. The first girl obtained the film and cheese simultaneously and positioned the cheese on the film. She made a tack seal on the hotplate, and passed the package to the second girl, who made the second and third seals and placed the package on a pan.

Wrapping at individual wrapping stations is 10 percent more efficient than the assembly-line technique. When each package is handled by two or more wrappers, there are delays because the time requirements of the two operators are not the same for different types of packages.

Individual wrapping stations should have all materials and tools at a convenient position. The storage area for the unwrapped product and the disposal area for the wrapped packages should be within easy reach of the wrapper. There should be a conveyor leading from the wrapping station to the weighing and pricing station. A Teflon cover for the hotplate or sealing iron should be used with polyvinyl chloride film.

One wrapper working alone can wrap approximately three packages per minute. The labor cost of retail store wrapping when the operator uses polyvinyl chloride film and works alone at an individual work station averages 1.36 cents per package (app. table 6).

WEIGHING AND PRICING

Bulk cheese was usually weighed and priced with the meat department's equipment. In this

evaluation certain assumptions were necessary: (1) The price per pound, the weight, and the package price must be on the label; and (2) an outside label should be used because oil from the cheese soils labels placed inside the package and detracts from package appearance.

Three systems of weighing and pricing were studied: (1) a low platform scale and hand-written pressure-sensitive labels, (2) a projected reading-type scale, which projects the weight and price on a screen, and a separate label printer (fig. 2), and (3) a combination electronic scale and printer.

Equipment is the major cost in weighing and pricing. The type that a store should use largely depends on the package volume for both meat and cheese and the wage rate. When the total number of meat and bulk cheese packages is under 1,000 per week, the pressure-sensitive label system should be used. The alternative is a heat seal label, since most meat departments use hand irons or hotplates in wrapping packages. When volume exceeds 4,000 packages a week, the electronic computing scale and printer combination is the lowest cost system (table 2).

The cost per package to weigh and price cheese also depends on the crew size and the methods

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FIGURE 2.—Projected reading-type scale and a separate label printer. The worker weighs the cheese and punches the weight and price into the label printer.

TABLE 2.—*Cost of equipment, material, and labor for weighing and pricing cheese in a retail meat department with alternative equipment*

[Based on total packages of meat and cheese handled]

Package volume and type of equipment [1]	Cost per year				Cost per package
	Labor [2]	Equipment [3]	Material [4]	Total	
1,000 packages per week	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Cents*
Scale and write-on pressure-sensitive label	562	90	73	725	1. 39
Scale and separate label printer	343	344	21	708	1. 36
Electronic computing scale and printer	192	922	21	1, 135	2. 18
4,000 packages per week					
Scale and write-on pressure-sensitive label	2, 246	90	291	2, 627	1. 26
Scale and separate label printer	1, 373	344	83	1, 800	. 87
Electronic computing scale and printer	770	922	83	1, 775	. 85
6,000 packages per week					
Scale and write-on pressure-sensitive label	3, 370	90	437	3, 897	1. 25
Scale and separate label printer	2, 059	344	125	2, 528	. 81
Electronic computing scale and printer	1, 154	922	125	2, 201	. 71

[1] To convert dollar sales to package volume, the total number of packages weighed and priced was related to total meat volume. In one firm, the conversion factor was $1.50. For dollar volume of any given meat department, the number of packages weighed and priced is determined by dividing total meat sales by $1.50. On the average, meat will represent 25 percent of total store sales. Thus, a store with a $24,000 weekly volume will have $6,000 in meat sales and 4,000 packages (6,000÷$1.50).

[2] Average wage rate was $2.40 per hour. Time requirements were: scale and pressure-sensitive label, 0.270 min.; scale and separate label printer, 0.165 min.; and electronic computing scale and printer 0.092 min.

[3] For details, see app. table 6.

[4] Pressure-sensitive label @14 cents and printer label @4 cents per 1,000.

used. These recommendations are reported in a previous publication.[2]

It was observed that some retail stores with label printers still used various preprinted labels to show whether the product was pasteurized or sliced, or the number of days it had been aged. The wrapper had to position the preprinted labels on the cheese before she began to wrap. The labels hindered the wrapping because they kept falling off, forcing her to be more careful when positioning the cheese on the film.

The total cost of using preprinted labels (0.38 cent per package) can be eliminated by using commodity identification slugs. The cost of using preprinted labels includes the labor to position label on cheese, the additional wrapping time, and a label cost of 90 cents per thousand.

The identification slugs can be used with both the electronic scale and the scale with separate label printer to print the additional information on the label. These special slugs cost approximately $2 each.

[2] Shaffer, Paul; Anderson, Dale; Wischkaemper, Paul; and Karitas, James. PACKAGING AND PRICE-MARKING PRODUCE IN RETAIL FOOD STORES. U.S. Dept. Agr. Mktg. Res. Rpt. 278, 85 pp., illus. 1958.

COST OF PACKAGING

In a store that packages bulk cheese in the meat department and has an average total store volume of $36,000 per week,[3] the cost to package bulk cheese using the improved equipment, materials, and work methods discussed in this report could be 4.3 cents per package.

This cost is based on cutting cheese at improved work stations with a wire jig, manual wrapping with polyvinyl chloride film at individual work stations, and weighing and pricing with the electronic scale and printer combination. (For details, see table 3, page 11.)

[3] This is the size of the typical new supermarket. THE SUPER MARKET INDUSTRY SPEAKS, 1964. Supermarket Institute, Inc., 16th Annual Report, 31 pp., illus. 1964.

PACKAGING CHEESE AT THE CENTRAL WAREHOUSE

CUTTING

At the central warehouse 90 percent of the cheese was cut on a hydraulically operated wire-cutting machine, which had different types of harps for cutting various shaped blocks (molds) of cheese.[4] The cutting machine could cut all rectangular blocks except items packaged with their original wrapping paper still on them (Brick cheese). The machine could cut Longhorn molds into half-moons, and cylindrical blocks of Blue cheese into wedges. Approximately 6 percent of the cheese was cut manually with a knife.

At the central warehouse the typical procedure for cutting cheese was for the cutter to obtain a block of cheese from a pallet or dolly and position it on a table, remove the cheese from its master container, and remove the wrapping paper or wax. The cheese was then trimmed of any mold or dirt. The operator positioned the block of cheese in the cutting machine, manually drew a wire arm through the cheese, making the horizontal cut, and then activated the hydraulic cutting mechanism to make the vertical cuts (fig. 3). The cheese was then placed on pans, which were sent by conveyor to the wrapping area.

The labor cost of cutting the four most popular varieties of cheese was—

	Cents [1]
Longhorn	0.32
Colby	.33
Aged Cheddar	.21
Swiss	.42
Average (weighted)	.32

[1] For details, see app. table 4.

Swiss cheese takes longer than the other cheeses because the block requires more trimming and the standard block is too large for most cutting harps. Therefore, the block must be cut down before it is placed on the cutting device. The least costly of the four varieties was the Aged Cheddar because it needed little trimming and it was easy to remove from its shipping container.

The average labor cost for cutting all the other varieties of cheese was 0.77 cent per package. Differences in cost for the various types of cheese were due to such factors as: (1) some items were cut manually, (2) blocks were different sizes, (3) the "make ready" and "put away" elements which occurred infrequently made up a larger proportion of the total time, and (4) when Blue cheese was cut, considerable time was required for cleaning the cutting harp.

The average labor cost for cutting all types of cheese into retail sale units at the central warehouse was 0.40 cent. This is 56 percent lower than the cost of store cutting. The average cost to manually cut Brick, Chunk American, and Red Wax Cheddar was 0.90 cent per package, and it was

[4] A mold is a term frequently used to describe a large block of cheese.

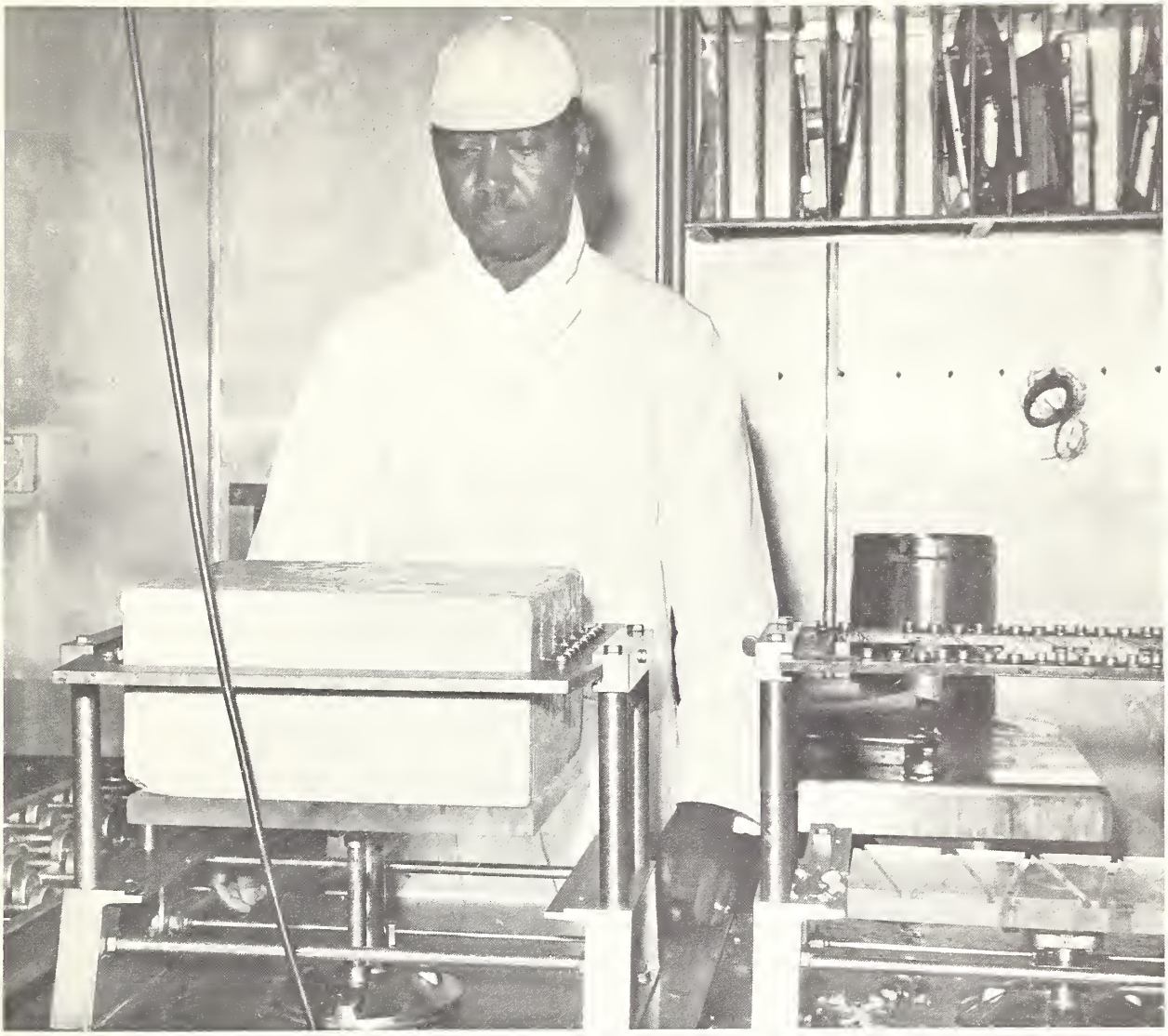

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FIGURE 3.—Hydraulically operated wire-cutting harp; block of cheese is pushed up through cutting wires.

0.35 cent for other varieties that were machine cut.

WRAPPING

Four basic methods for central packaging of bulk cheese were analyzed: (1) manual wrapping at individual wrapping stations with polyvinyl chloride film, (2) manual wrapping by the assembly-line technique, with an automatic sheeter supplying the film, (3) automatic wrapping with a "gas flush" packaging machine that uses a laminated film, and (4) automatic wrapping with a machine that uses polyvinyl chloride film.

Manual Wrapping

The two principal systems of manually wrapping bulk cheese at the central warehouse both use conveyors to move wrapped cheese to the pricing area and on to the packout table.

One system used individual wrapping stations (fig. 4). Between the wrapping stations and the weighing area there frequently was a heat tunnel, which pulled the polyvinyl chloride film more securely about the package. The method of wrapping was the same as at the retail store except the work stations had several different sizes of film.

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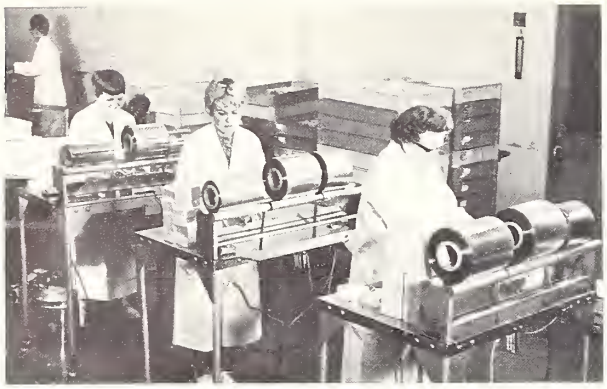

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FIGURE 4.—Wrapping stations with rolls of film of various widths.

Having different sizes of film can reduce film requirements because the operator can better adjust the film to the package size. The labor costs to manually wrap cheese at the central warehouse are detailed in appendix table 6.

The second method used an assembly line and an automatic sheeter. This machine automatically cut off a preset amount of film at a preset rate of speed (up to 36 sheets per minute). The machine could also be operated by a foot lever to obtain individual sheets. The automatic feed tends to pace the operation. The procedure in one packaging operation using a sheeter was as follows: (1) Operator number one obtained a piece of cheese and positioned it on the film; (2) operator number two, working across the machine from operator one, folded the film over the package, made the first heat seal on a small hotplate, and placed the package on a conveyor; (3) operator number three removed the package from the conveyor, completed folding and sealing, and replaced the package on the conveyor (fig. 5). The conveyor carried the package through a heat shrink tunnel and on to the weighing and pricing station. The third job required the most skill in order for it to be performed in the same length of time as the other jobs, so the assembly line did not have a balanced workload. For optimum production, the girl with most dexterity should be assigned to the job of making the last folds and seals, or if the girls are of the same ability, the jobs should be rotated.

Machine Wrapping

Two types of automatic equipment for packaging cheese were studied. The gas flush packaging machine was most commonly used. This machine wraps cheese in laminated film and then removes air from the package and replaces it with nitrogen or carbon dioxide. The cheese is wrapped rather loosely to provide space for the gas. This gives some flexibility in the size of the unit being packaged. This equipment, which is illustrated in figure 6, has an effective speed of 60 packages per minute. An operator places the cut cheese pieces on a conveyor, which takes them to the wrapping machine. Another operator checks the packages for leaks as they are moved from the

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FIGURE 5.—Operator No. 1 (back to camera) positions cheese on film fed by automatic sheeter; operator No. 2 (across from No. 1) folds the film over the package, makes the first heat seal, and places package on conveyor; operator No. 3 completes wrapping and sealing and replaces package on conveyor.

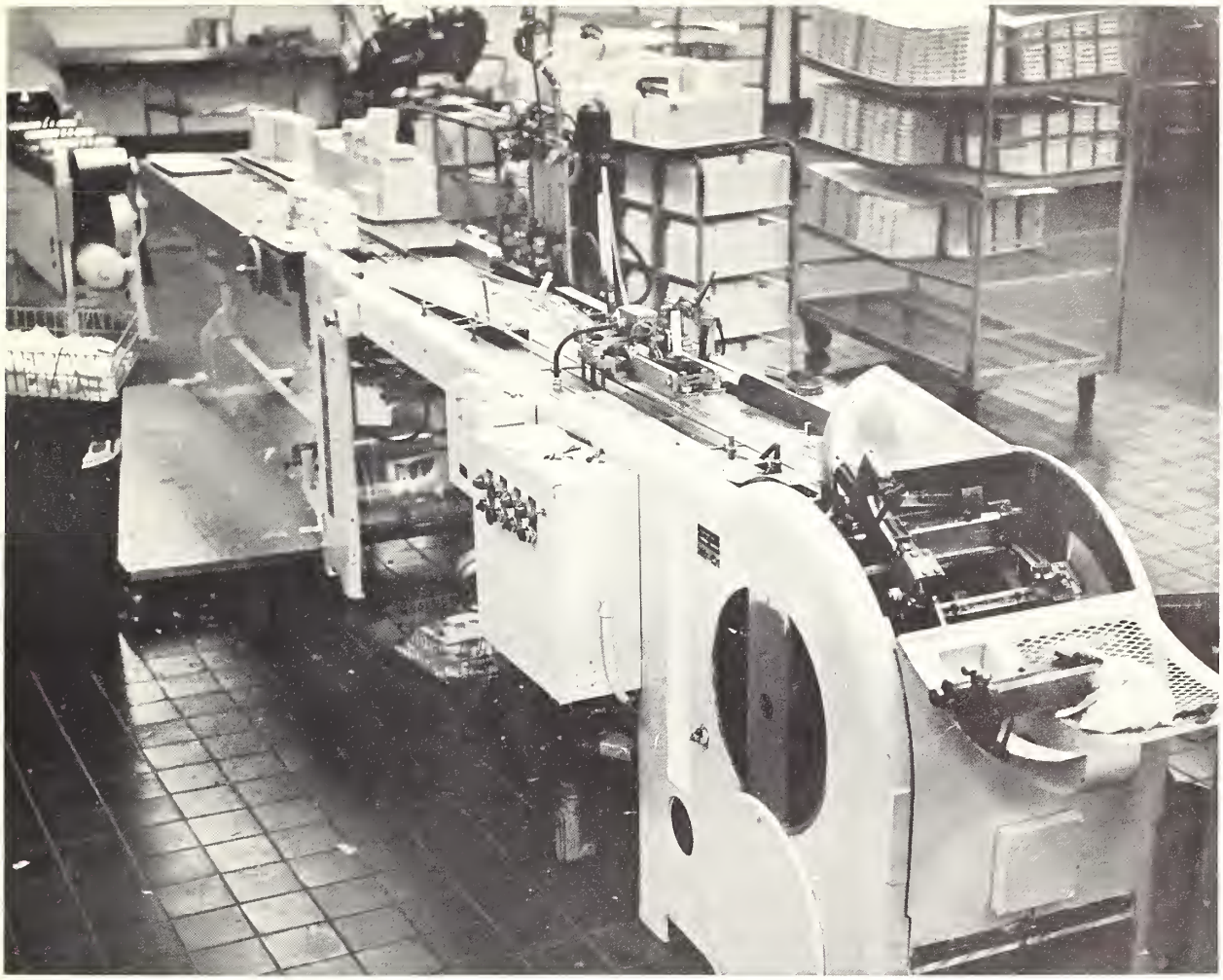

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FIGURE 6.—"Gas flush" packing machine installation. Operator places cheese on film (see stacks of cut cheese in background); machine wraps cheese and ejects package onto conveyor (not shown).

machine onto a take-away conveyor. A visual check will spot the obvious leakers. In addition, random packages are immersed in water to check the package seal.

Packages from this automatic line are weighed and priced on electronic computing scales and, in some instances, the label is automatically placed on the package.

The laminated film is considerably more expensive than cellophane or polyvinyl chloride, but gives a shelf life of approximately 30 days.

The second piece of equipment automatically wraps, with polyvinyl chloride film, rectangular pieces of cheese (approximately 62 percent of the packages) that do not vary in weight by more than one ounce (fig. 7). This equipment has lower fixed costs than the gas flush machine and the film costs considerably less. The machine will not handle a wide variety of package sizes and shapes and has a low package weight tolerance.

No attempt was made to measure the relative shrinkage of the packages produced by the two types of equipment. The gas flush package will give more protection to the product, but it was not determined whether possible reductions in shrinkage would offset the higher packaging costs.

Cost Comparison

The gas flush system has the highest rate of production and the lowest labor cost, but the cost of the laminated film (1.71 cents per package) is five times higher than the cost of the polyvinyl chloride. The laminated film gives the package a longer shelf life, which in some cases compensates for the higher cost.

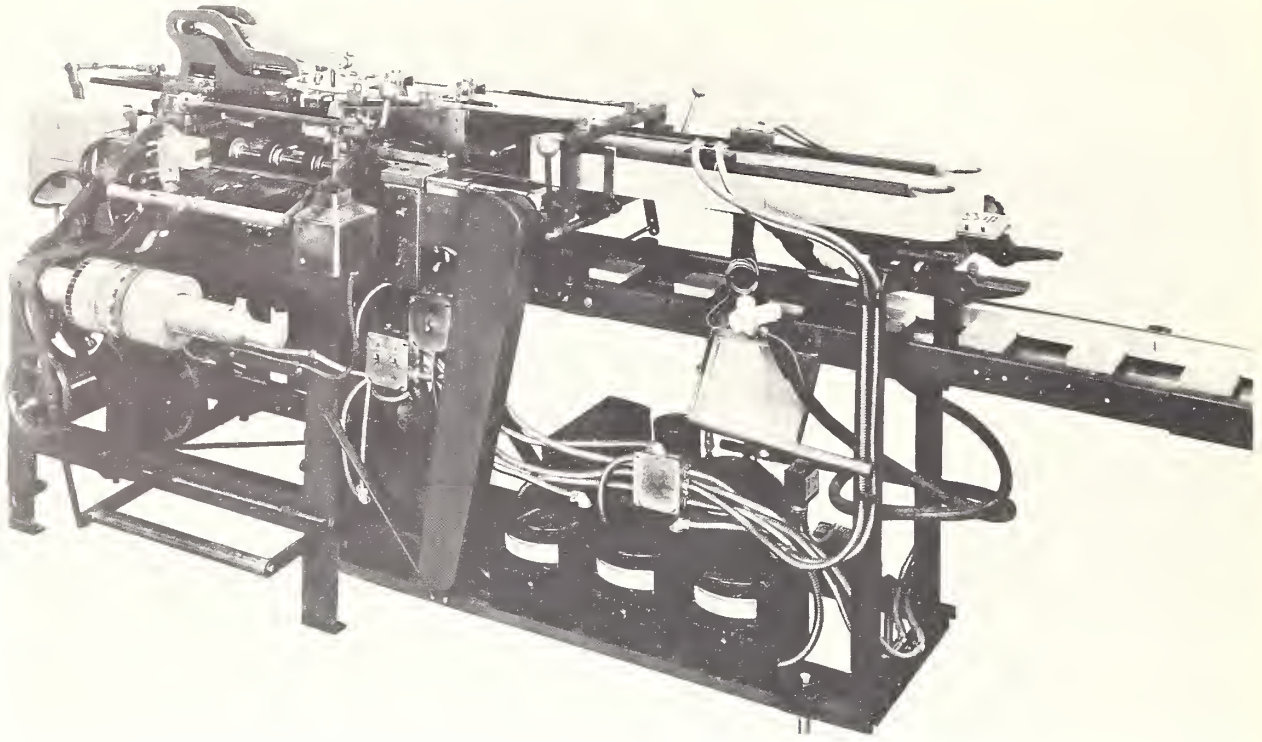

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FIGURE 7.—This automatic wrapping machine uses polyvinyl chloride film; product must be virtually "even weight." Cheese feeds into the machine at right, and wrapped cheese is ejected onto a conveyor (not shown) above the feed-in.

The automatic wrapping machine that uses polyvinyl chloride film is the least costly mechanical system, providing the firm does not require a variety of package weights.

The assembly line with the automatic film sheeter is the lowest cost method of manually wrapping cheese at the central warehouse. The labor costs are a little over half those of the manual wrapping stations. Material costs are slightly higher for the automatic sheeter packaging system. The following tabulation shows the labor cost per package to wrap cheese by four methods at the central warehouse:

	Cents
Manual	1.96
Manual with sheeter	1.41
Machine with polyvinyl chloride film	1.39
Gas flush machine	[1].97

[1] For details, see table 3, page 11.

A system using a combination of the automatic polyvinyl chloride film wrapping machine for high-volume items and an automatic sheeter for all other items would be the lowest cost method of packaging. Before a firm decides which system to use, it must determine whether it wants a variety of package weights and the importance of long shelf life.

WEIGHING AND PRICING

Even Weight Vs. Catch Weight

When cheese of even weight is packaged, a preprinted label, which is automatically applied, substitutes for the weighting and pricing operations. "Catch weight" packaging is more common because it is virtually impossible to cut bulk cheese so the packages have exactly the same weight. If the firm packs even weight packages, it must overpack to be certain the prescribed weight is in the package. For example, if cheese sells for 69 cents a pound and a firm overpacks ¼ ounce, on the average, each package costs the firm an additional 1.08 cents. Even weight packaging requires blocks of uniform size, which are more expensive to buy than random shape blocks, and the cost of cutting cheese for even weight packages is higher than for catch weight packages, because of added labor requirements and increased shrinkage due to more scrap pieces.

Automatic Weighing and Pricing

It is possible to have a catch weight cheese packaging operation that is almost fully automatic. All the central warehouses studied used electronic

computer scales, which automatically weigh the cheese and prepare a label. The operator attaches the label to the package and places the package in a container or pan or in an accumulation area. This automatic equipment can be most effectively used if these suggestions are followed:

1. Wrapped packages should be conveyed to an accumulating turntable located next to the scale and printer.
2. The product should flow from left to right. The right hand typically has a greater capacity for work and should be more fully utilized than the left hand.
3. The sequence of motions should provide for the maximum utilization of both hands. The operator removes the weighed package from the scale with his right hand and touches it to the label on the activator, while obtaining an unweighed package and placing it on the scale with his left hand.
4. The electronic computer part of the scale should be located below the work area.
5. The rack for identification slugs should be mounted on a shelf directly over the scale, with the most commonly used slugs placed on the lower level and the least used slugs on the higher level.
6. Codes, tare weights, and price per pound should be conveniently posted where the operator can see them without leaving the weighing station.
7. The disposal area should be at a height convenient for the operator.

Automatic Labeling

The electronic computing scale prepares the label but does not apply it to the package. This can be done with an automatic labeler used in conjunction with the electronic scale. The wrapped package is moved across the scale and onto the labeler by an indexing device, and the label is automatically positioned and attached to the package.

Although weighing and labeling are fully automatic, a worker is still required, because (1) the wrapped and labeled packages have to be hand-stacked in the shipping container (in the conventional operation this was combined with the application of the label to the package),[5] (2) someone must set the tare weight and the price per pound and change the commodity slugs for each run, and (3) all packages cannot be labeled automatically because the labeling machine cannot handle odd-shaped packages.

[5] Container filling could be eliminated by letting the packages fall at random into the shipping container, but (1) the shipping container capacity would be reduced, which means that more shipping containers would be required for a given volume, (2) the transportation cost and the cost for storage space would be higher because of loss in utilization of space in the shipping containers, and (3) the time to display a package would be increased when the package was taken from a jumbled pack.

Variations in package size create another problem for the automatic labeler: the uniform positioning of the label on the package. Some firms that have automatic labelers station a girl at the scale and printer to make sure that the label is properly positioned on the package and that only one package goes on the scale at one time. If the packaging is done by the gas flush technique, the girl can also make a visual check to see if the package is sealed correctly.

Weight and Price Accumulation

With a recording machine attachment, it is possible to record and accumulate the weights or retail selling prices of all packages that go across the electronic computer scale. Shrinkage can be computed per item run or per day by comparing the reading with opening inventory. The device is also useful in billing packaged cheese to the retail store.

Cost of Weighing and Pricing

Most firms who package bulk cheese at the central warehouse package on a catch weight basis and use an electronic computer scale for weighing and pricing. If the firm's output is 1 million packages a year, the costs are—

Equipment, interest, and maintenance[1]	$922
Label cost at 40 cents per 1,000 labels	400
Labor cost at 0.092 minute per package and $2.16 per hour	3,310
Total cost per year	4,632
Cost per package (cents)	0.46

[1] For details, see app. table 7.

In comparison, the cost for pricing at the retail store with the electronic scale and printer combination would be 0.71 cent per package. The difference between the cost at the store and at the warehouse is the better utilization of equipment and the lower wage rate at the warehouse.

When the cost for weighing and pricing at the central warehouse is compared with the average cost at retail stores in a given organization or group, the difference may be even greater. For this comparison it is assumed that the type of equipment used at each retail store would depend on the average sales or package volume. It is also assumed that 53 percent of the stores have a weekly volume in excess of $24,000 and use the electronic scale and printer combination (0.71 cent per package); 13 percent have a weekly volume between $10,000 and $24,000 and use the scale and separate printer (0.87 cent per package); and 34 percent have a weekly volume under $10,000 and use a scale and handwritten labels (1.39 cents per package). The average cost for this group of stores would be 0.95 cent per package.

CONTAINERS FOR SHIPPING PACKAGED CHEESE TO RETAIL STORES

Studies of container handling were made in two firms; in one only 10 percent of the paperboard containers, on the average, were returned from the stores; the other used a stronger container that could be returned and used for approximately 300 trips. In the first firm, the package was conveyed to an assembly area where it was packed into one of two paperboard containers (15 or 30 pounds), which was positioned on a tare weight scale. When filled, the box was stapled closed, positioned on a pallet, and moved to the selection line. This firm packed for inventory or in anticipation of sales. Some of the stores would return this semi-returnable container to the warehouse.

The second firm used returnable containers and each day packaged only what was ordered by the stores. The scale operator placed the package in the container as part of the weighing and pricing operation. The container, which had a capacity of 40 pounds, was then placed on a pallet designated for shipment to a particular store.[6] Shipping packaged bulk cheese in returnable containers cost 0.15 cent per package less than shipping in semireturnable containers (app. table 10). A firm selling 1 million packages a year would save $1,500 annually.

[6] An operation using a returnable container and packing for inventory was not included in this study. Previous studies on other commodities indicate that packing for inventory is less costly than packing for store orders, especially when the average pack per item and the order size are large.

COST OF ALTERNATIVE METHODS OF PACKAGING BULK CHEESE

The final cost comparison of packaging bulk cheese at the store and warehouse includes all chargeable costs: labor, materials, equipment, shipping containers for warehouse packaging, and burden (rent, utilities, insurance, laundry, etc.).

Packaging at the central warehouse costs less than packaging at the retail store (table 3). The table shows costs for the least expensive method of packaging at the retail store and for four methods of wrapping at the warehouse. The lowest costs for packaging at the warehouse are found when the cheese is manually wrapped by the assembly-line technique, using an automatic film sheeter. A firm with an average annual volume of 1 million packages would realize a savings of $19,000 a year, a reduction of 44 percent over retail store packaging.

When specialized equipment is used at the central warehouse, the labor cost for cutting bulk cheese is 56 percent lower than the cost of cutting in the retail store. When the gas flush automatic wrapper is used centrally, rather than the manual wrap at the retail store, labor costs for wrapping are reduced by 86 percent. The most significant saving when packaging of bulk cheese is moved to the central warehouse is in labor costs, which are reduced from 2.92 cents to 0.97 cent per package (for the gas flush system), a reduction of 67 percent. The amount of polyvinyl chloride film used for any manual wrapping system was lowest when the operator, working at a fixed workplace, could choose from four sizes of film to better adjust film to size of unit.

The automatic wrapper that uses polyvinyl chloride film is the lowest cost method of machine packaging, but it can only be used for rectangular packages whose weights vary no more than 1 ounce. This limits its use to packaging in the production areas or terminal warehouses with sufficient volume for several packaging lines.

The high cost of the automatic gas flush packaging equipment is compensated for by longer shelf life of the cheese.[7]

The only systems that can handle all varieties and sizes of cheese packages are the manual wrapping methods. A central machine operation will, therefore, require a second line to handle odd-shaped packages and those that move in low volume. A manual cheese packaging operation at the central warehouse is less costly than manual packaging at the retail store.

The meat departments of supermarkets, where cheese is typically packaged, are not designed for packaging cheese and the volume of cheese packaged is relatively small (540 packages per week in an average size store). A central warehouse packaging plant with specialized equipment and skilled personnel affords an opportunity to lower the cost of packaging bulk cheese. Automatic equipment can be used to cut and package most of the cheese items. Larger volumes allow the firm to package a wider variety of items. Trained personnel result in better control of quality, improved sanitation, and better package appearance. Larger blocks of cheese lower the purchasing price and reduce cutting costs. It is easier to

[7] The cost of gas flush packaging can be reduced slightly by using a piece of equipment called a "package leak analyzer" instead of the operator who checked the packages for leaks during this study. The package leak analyzer automatically analyzes each package and determines if it has a leak.

adjust film usage to the package at the central plant than at the retail store. Film that increases shelf life can be used on the automatic packaging equipment. The typical retail store is not large enough to economically process and package perishable items. Bulk cheese, because of its relatively long shelf life, should be one of the first items to be packaged centrally.

TABLE 3.—*Cost per package for packaging bulk cheese at the retail food store and at the central warehouse*

Method of packaging	Labor				Material	Equipment	Burden	Containers	Total cost per package
	Cutting	Wrapping	Weighing and pricing	Other					
Retail store: [1]	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*
Cutting with a wire jig, manual wrapping with polyvinyl film at individual work stations, weighing and pricing with electronic scale and printer combination	0. 91	1. 36	0. 65	------	0. 36	[2] 0. 24	[3] 0. 81	--------	4. 33
Central warehouse: [4]									
Cutting with a wire-cutting machine, weighing and pricing with electronic computer scale, and wrapping.									
a. Manually at individual work stations	. 40	1. 20	. 14	0. 22	. 33	. 11	. 44	0. 08	2. 92
b. Manually by assembly-line technique, with an automatic sheeter	. 40	. 65	. 14	. 22	. 35	. 13	. 45	. 08	2. 42
c. With machine using polyvinyl chloride film	. 40	[5] . 63	. 14	. 22	. 35	. 18	. 47	. 08	2. 47
d. With gas flush packaging machine	. 40	[6] . 19	. 14	. 24	1. 75	. 36	. 54	. 09	3. 71

[1] Based on a store with an average volume of 6,000 packages of meat and cheese per week.

[2] See table 2 for details of equipment at different volume levels. It was assumed that 53 percent of the stores served by a central warehouse would have a volume in excess of $24,000 a week and use the electronic computing scale, 13 percent would have a volume in excess of $10,000 a week and use the scale with separate printer, and 34 percent would have a volume under $10,000 a week and use the scale and printed label. The weighted average equipment cost was 0.24 cent per package. (See table 8 for details of equipment at warehouse.)

[3] Trade sources ("Super Market Industry Speaks") report average operating burden is 2.92 percent of sales. A 6,000-package-a-week meat department represents a store with an average volume of $1,872,000 and an area of 20,400 sq. ft. $1,872,000×0.0292 (2.92 percent)÷20,400=$2.68 burden per square foot. A typical meat preparation area is 940 sq. ft. 940×2.68÷312,000 packages =0.81 cent per meat or cheese package. (See table 9 for burden charges at warehouse.)

[4] Based on average volume of 1 million packages per year.

[5] 62 percent were wrapped by machine at 0.066 minute per package and 38 percent were handwrapped at 0.352 minute per package and $2.40 per hour.

[6] 96 percent were wrapped by machine at 0.040 minute per package and 4 percent were handwrapped at 0.352 minute per package and $2.40 per hour.

APPENDIX

TABLE 4.—*Labor costs for cutting bulk cheese at the retail store and the central warehouse*

Type of cheese	Average weight per sale unit	Movement based on sale unit	Retail store [1]			Warehouse [2]		
			Weight of loaf	Time per unit	Cost per unit	Weight of loaf	Time per unit	Cost per unit
	Ounces	*Percent*	*Pounds*	*Minutes*	*Cents*	*Pounds*	*Minutes*	*Cents*
Longhorn	11. 6	32. 5	13	0. 156	0. 92	13	0. 067	0. 32
Colby	13. 3	22. 8	40	. 109	. 64	40	. 069	. 33
Aged Cheddar	13. 3	15. 2	40	. 191	1. 13	10	. 043	. 21
Swiss	13. 3	10. 7	10	. 142	. 84	80	. 088	. 42
Brick	13. 7	4. 6	6	. 194	1. 14	6	. 188	. 90
Blue	6. 2	4. 1	6	[3] . 251	1. 48	5	. 191	. 92
Medium Cheddar	13. 3	3. 2	10	. 134	. 79	[4] 10	. 100	. 48
Sliced American	13. 3	2. 6	5	. 114	. 67	5	. 114	. 55
Chunk American	13. 3	1. 9	5	. 217	1. 28	5	. 207	. 99
Red Wax Cheddar	13. 7	1. 4	12	. 196	1. 16	12	. 167	. 80
Caraway	13. 3	1. 0	10	. 164	. 97	10	. 135	. 65
Weighted average				. 155	. 91		. 084	. 40

[1] The retail meatcutters make $3.08 per hour, plus 15 percent for fringe benefits, a total of $3.54 per hour. The cost includes a 15 percent personal and fatigue allowance.

[2] Labor cost is $2.88 per hour, which includes 15 percent for fringe benefits and a 15 percent personal and fatigue allowance.

[3] The cheese was sliced by the manufacturer yet it required the most labor. The time stated is for (1) handling the shipping container, (2) removing the product from its wrappers, and (3) breaking the sliced loaf into six retail units.

[4] At the warehouse where the study was made, only 10-pound loaves were purchased. It would have been more economical to purchase larger loaves.

TABLE 5.—*Cost per package for using polyvinyl chloride film and cellophane for wrapping bulk cheese at the retail store*

Cost item	Polyvinyl chloride	Cellophane
	Cents	*Cents*
Film	[1] 0. 32	[2] 0. 28
Labor [3]	1. 36	1. 29
Total [4]	1. 68	1. 57

[1] Polyvinyl chloride at 3.3 cents per 1,000 sq. in.; 97 sq. in. per package.

[2] Cellophane at 3.0 cents per 1,000 sq. in.; 95 sq. in. per package.

[3] Wage rate of $2.40 per hour, which included 15 percent for fringe benefits.

[4] Based on an average package weight of 12.4 ounces.

TABLE 6.—*Labor cost per package for one operator manually wrapping bulk cheese with polyvinyl film at individual wrapping stations at the retail store and the central warehouse*

Type of cheese	Average weight per sale unit	Movement based on weight	Central warehouse [1]		Retail store [2]	
			Wrapping time per sales unit	Labor cost per sales unit	Wrapping time per sales unit	Labor cost per sales unit
	Ounces	*Percent*	*Minutes*	*Cents*	*Minutes*	*Cents*
Longhorn	11. 6	30. 5	0. 371	1. 34	0. 351	1. 40
Colby	13. 3	24. 6	. 307	1. 10	. 332	1. 33
Aged and medium Cheddar	13. 3	19. 7	. 297	1. 07	. 343	1. 37
Swiss	13. 3	11. 4	. 330	1. 19	. 319	1. 28
Brick	13. 7	4. 2	. 371	1. 34	. 355	1. 42
American	13. 3	4. 9	. 338	1. 22	. 346	1. 38
Blue	6. 2	2. 2	. 336	1. 21	. 363	1. 45
Red Wax Cheddar	13. 7	1. 5	. 318	1. 14	. 342	1. 37
Caraway	13. 3	1. 0	. 378	1. 36	. 385	1. 54
Weighted average			. 333	1. 20	. 341	1. 36

[1] Labor standards included a 15-percent personal and fatigue allowance. The wage rate is $2.16 per hour, which included 15 percent for fringe benefits.

[2] The average wage was $2.40 including a 15-percent allowance for fringe benefits.

TABLE 7.—*Annual costs of equipment for weighing and pricing cheese in a retail meat department using three types of equipment*

Cost factor	Scale and write-on pressure-sensitive label	Scale and separate label printer	Electronic computing scale and printer
	Dollars	*Dollars*	*Dollars*
Prepack scale [1]	48	70	
Scale-printer combination [1]		106	
Electronic computing scale and printer [1]			450
Label activator [2]		20	
Commodity slugs [2]		40	40
Interest on investment [3]	12	52	117
Maintenance of scale only [4]	20		
Maintenance of scale and printer [5]		46	305
Weighing table (@ $100) [1]	10	10	10
Total equipment cost per year	90	344	922

[1] 10-year depreciation.

[2] 5-year depreciation.

[3] 5 percent on total cost of equipment for ½ the life of the equipment.

[4] Based on two calls per year @ $10 per call.

[5] Based on service contract.

TABLE 8.—*Annual equipment costs and cost per package for four methods of packaging bulk cheese at the central warehouse*

Cost factor	Manual wrapping	Automatic sheeter w/ assembly line	Polyvinyl chloride machine wrapping	Gas flush machine wrapping
	Dollars	*Dollars*	*Dollars*	*Dollars*
Cheese cutting machine	3, 500	3, 500	3, 500	3, 500
Cheese cutting table	240	240	240	240
Combination electronic scale and printer	4, 500	4, 500	4, 500	[1] 9, 000
Automatic labeler				5, 600
Commodity slugs for printer, 16 at $2 per slug	32	32	32	64
Tare weight scale	800	800	800	800
Turntable for pack-out	400	400		
Conveyors	400	400	600	600
Wrapping stations at $250	1, 000		500	
Wrapping table at $150		300		
Packaging machine			8, 000	16, 000
Automatic sheeter		2, 500		
Total equipment cost	10, 872	12, 672	18, 172	35, 804
Depreciated total (10 years)	1, 087	1, 267	1, 817	3, 580
	Cents	*Cents*	*Cents*	*Cents*
Cost per package [2]	0. 11	0. 13	0. 18	0. 36

[1] Two scales required to equal volume of wrapping machine.

[2] Based on an annual volume of 1 million packages.

TABLE 9.—*Annual burden charges for four methods of packaging bulk cheese at the central warehouse*

Cost factor	Manual wrapping	Automatic sheeter w/ assembly line	Polyvinyl chloride wrapping machine	Gas flush wrapping machine
	Dollars	*Dollars*	*Dollars*	*Dollars*
Interest on invested capital @ 5% [1]	272	319	454	895
Maintenance of electronic scale and printer	305	305	305	610
Miscellaneous maintenance and repairs	100	175	300	325
Rent and utilities	1, 205	1, 205	1, 205	1, 205
Insurance	44	44	44	44
Laundry	240	220	160	160
Miscellaneous order form	109	109	109	109
Supervision	2, 093	2, 093	2, 093	2, 093
Total cost per year	4, 368	4, 470	4, 670	5, 441
	Cents	*Cents*	*Cents*	*Cents*
Cost per package [2]	0. 44	0. 45	0. 47	0. 54

[1] For ½ life of equipment; see table 8 for investment in equipment.

[2] Based on an annual volume of 1 million packages.

TABLE 10.—*Costs of using returnable and semireturnable containers for shipping packaged cheese from the central warehouse to the retail store* [1]

Cost factor	Semireturnable containers		Returnable containers	
	Time per unit	Cost per unit	Time per unit	Cost per unit
Labor:	*Minutes*	*Cents*	*Minutes*	*Cents*
Assemble boxes	[2] 0.009	0.03		
Fill and close	[3] .005	.02		
Fill			[3] 0.029	0.14
Extra warehouse and store handling	[3] .010	.05	[3] .016	.08
Material:				
Container		[4] .35		[5] .07
Label				[6] .01
Cost per package		.45		.30

[1] 1 million packages are shipped from the warehouse each year.

[2] $2.16 per hour for female.

[3] $2.88 per hour for male. Time includes obtaining empty container.

[4] The weighted cost per box was 9.19 cents, less 10 percent for the containers that are returned.

[5] The container cost $5.05, will make 1½ trips per week, and last 4 years.

[6] The label is used to identify the store. The semireturnable container is stamped with the name of the store.

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